

LA-UR-22-25309

Approved for public release; distribution is unlimited.

Title: Predicting canopy height from commercial satellite imagery

Author(s): Abolt, Charles Joseph

Intended for: Presentation for seminar with the California Forest Observatory

Issued: 2022-06-07



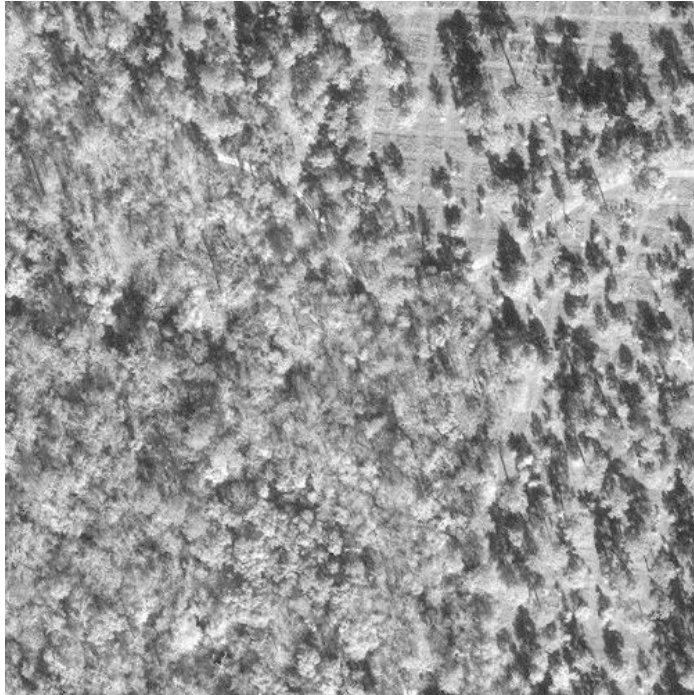
Los Alamos National Laboratory, an affirmative action/equal opportunity employer, is operated by Triad National Security, LLC for the National Nuclear Security Administration of U.S. Department of Energy under contract 89233218CNA000001. By approving this article, the publisher recognizes that the U.S. Government retains nonexclusive, royalty-free license to publish or reproduce the published form of this contribution, or to allow others to do so, for U.S. Government purposes. Los Alamos National Laboratory requests that the publisher identify this article as work performed under the auspices of the U.S. Department of Energy. Los Alamos National Laboratory strongly supports academic freedom and a researcher's right to publish; as an institution, however, the Laboratory does not endorse the viewpoint of a publication or guarantee its technical correctness.

Predicting canopy height from commercial satellite imagery

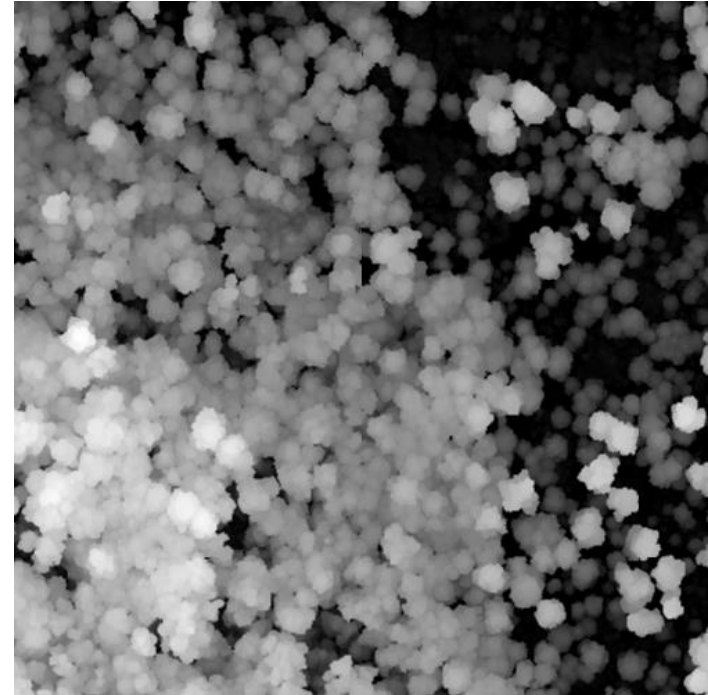
Chuck Abolt

June 7, 2022

Example of satellite imagery and lidar-derived CHM



50m



Data we have access to:

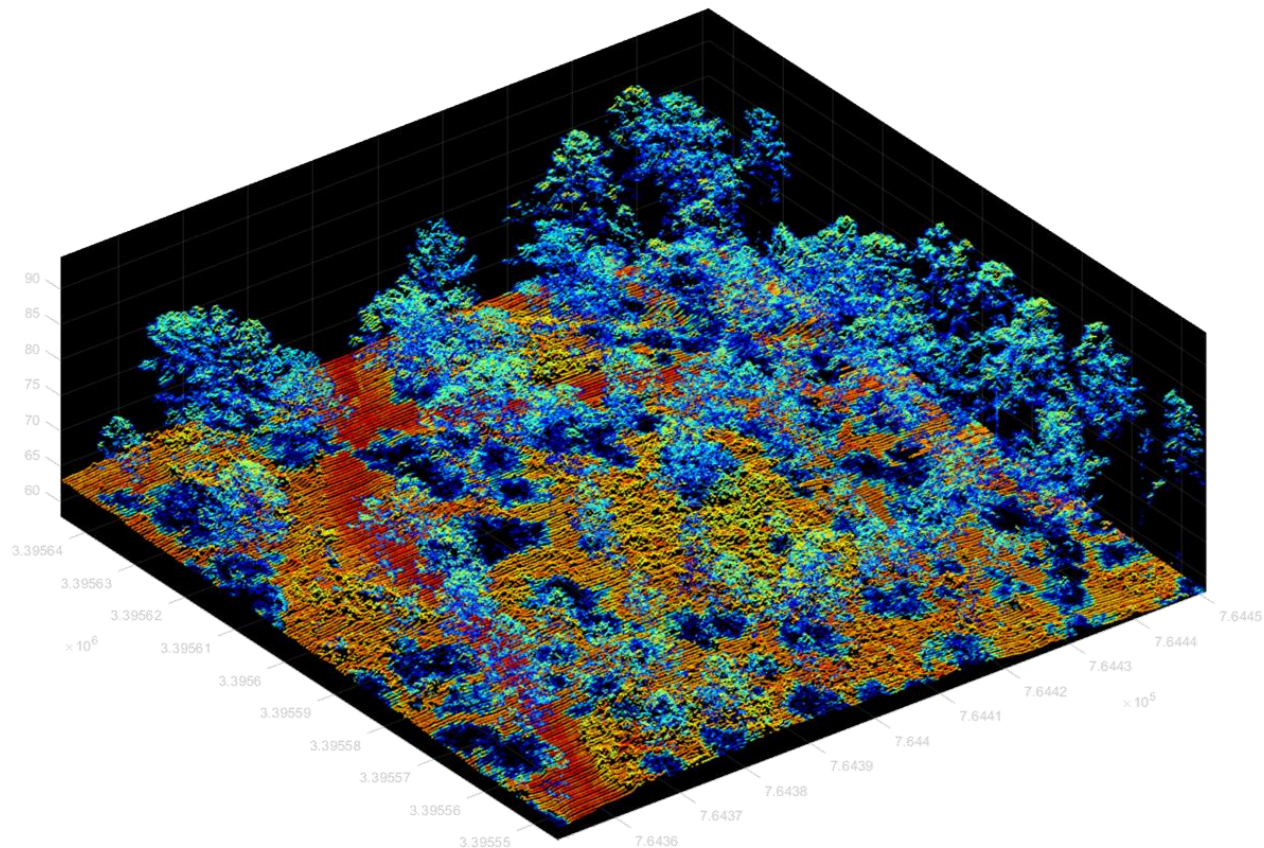
Lidar (canopy height) data:

- ALS point clouds (up to 50 pts/m²) from Scott Pokswinski, covering a few tens of square kilometers
- CHMs at 25cm resolution from Xu et al. (2018), covering >18,000 km² of forests in California

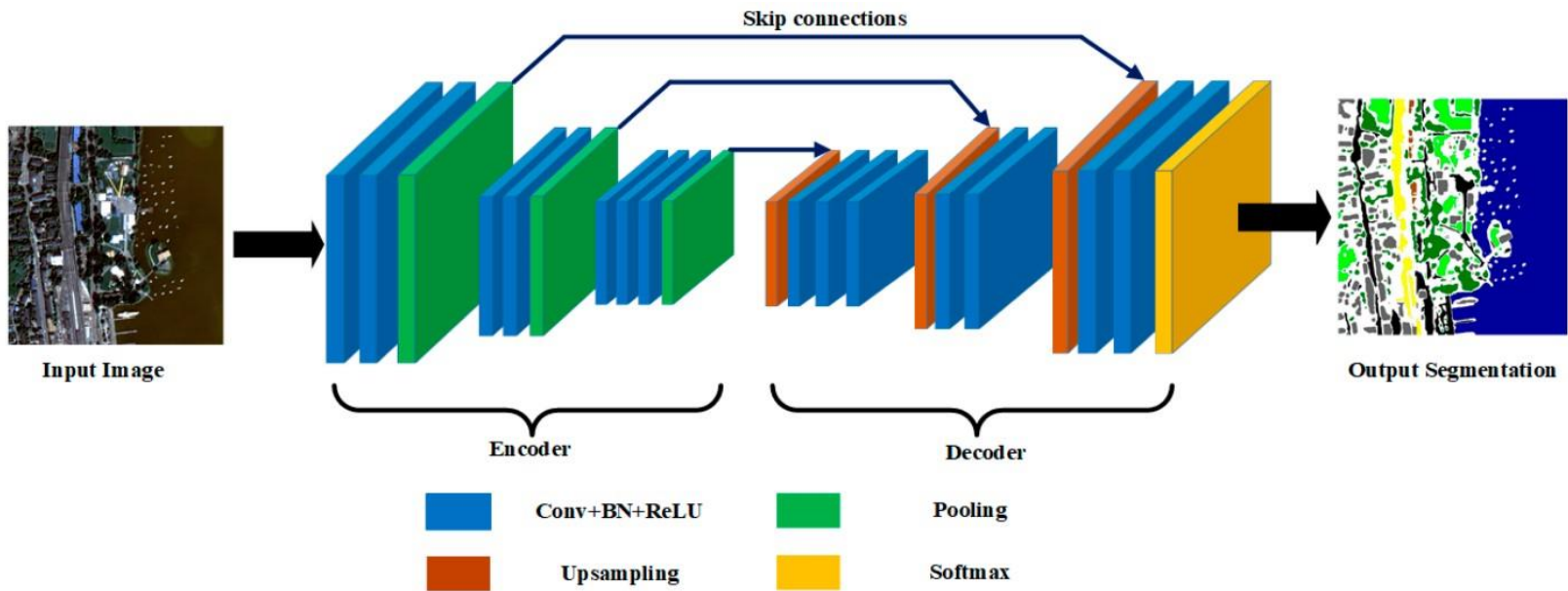
High resolution satellite imagery:

- WorldView 1, 2, and 3 data from Maxar/Digital Globe: panchromatic at ~0.5m resolution, RGB and multispectral at ~1-2m resolution
- Planet Labs data, which is lower spatial resolution but higher temporal resolution than WorldView

Example of full resolution point cloud data



U-nets and semantic segmentation



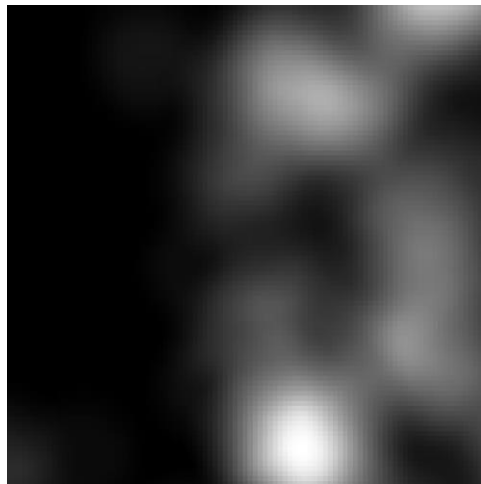
<https://medium.com/@rishabhjain4891/remote-sensing-and-its-future-2caee3f8dd40>

First Second stab at CHM estimation

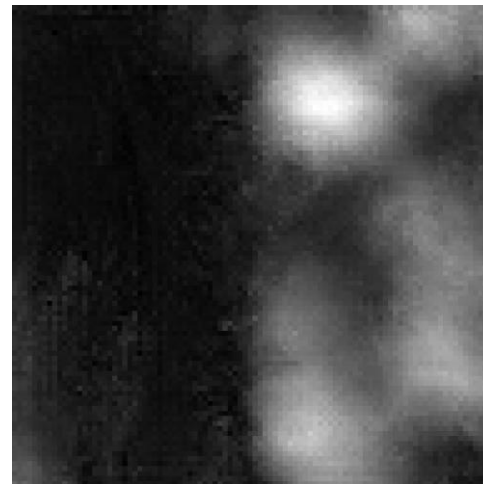
Input: 50cm grayscale imagery



Target: lidar-derived CHM



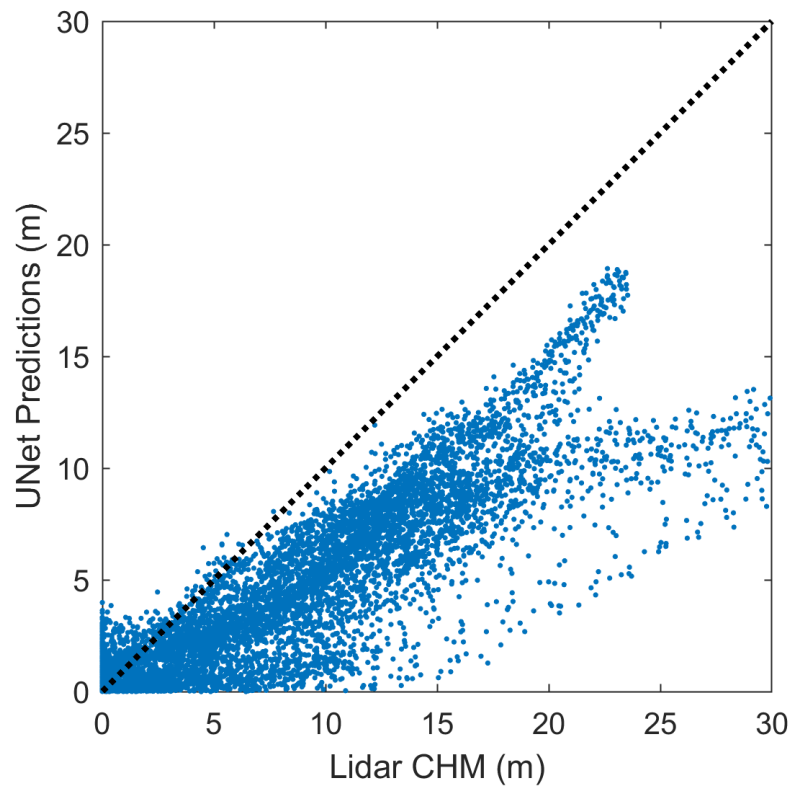
Output: Predicted CHM



Current problems, paths forward

- Currently using grayscale imagery; more information can be included using additional data types
- May be infeasible to estimate CHM at current horizontal resolution (50 cm); California Forest Observatory does it at 10 m
- Tree tops in satellite imagery are displaced due to satellite's off-nadir angle
 - Can this be exploited for photogrammetry?

Current problems, paths forward



Ideas for collaboration

- We have access to sub-meter resolution panchromatic imagery and 1-2 m resolution RGB and multispectral
 - Comparison with multispectral from Planet: what is the finest resolution at which we can estimate fuel characteristics? Is there a trade off between precision and accuracy?
- CFO gets great results using 10m resolution Sentinel radar and multispectral data. Can we combine these data sources with submeter-resolution WorldView data to get accurate, fine-scale estimates of fuel characteristics?